CLAIMS

What is claimed is:

1. A device for manipulating particles using dielectrophoresis, the device comprising:

a substrate across which the particles move;

a non-uniform array of insulating features on the substrate; and

a plurality of electrodes positioned to generate a spatially non-uniform electric field across the non-uniform array.

2. A device according to claim 1, wherein the insulating features vary in size across at least a portion of the substrate.

3. A device according to claim 1, wherein the insulating features vary in shape across at least a portion of the substrate.

4. A device according to claim 1, wherein spacing between adjacent features in the array varies across at least a portion of the substrate.

5. A device according to claim 1, wherein the insulating features are formed on a wall of a channel or chamber.

6. A device according to claim 1, wherein the substrate comprises glass or polymer.

7. A device according to claim 1, wherein the insulating features comprise an insulating material supported by a non-insulating material.

8. A device according to claim 1, further comprising a voltage source connected to the plurality of electrodes.

9. A device according to claim 5, further comprising a fluid port connected to the channel or chamber.

10. A device according to claim 1, wherein the spatially non-uniform electric field generated across the ridges exerts a dielectrophoretic force on at least one of said particles.

11. A device according to claim 10, wherein said particles comprise particles selected from the group of particles consisting of bacteria, cells, and viruses.

12. A device according to claim 1, wherein the non-uniform array is a radial array.

13. A device according to claim 12, wherein the insulating features comprise posts, and the diameter of the posts increases according to their radial position in said radial array.

14. A method for manipulating particles using dielectrophoresis, the method comprising:

generating a spatially non-uniform electric field;

passing a sample fluid containing the particles across the non-uniform array, the spatially non-uniform electric field exerting a dielectrophoretic force on the particles thereby constraining motion of at least one particle; and

trapping at least one particle at a location in the non-uniform array, wherein the location is determined at least in part based on electric and geometrical properties of the particle.

15. A method according to claim 14, further comprises trapping a first group of particles having a first dielectrophoretic mobility at a first location in the non-uniform array and a second group of particles having a second dielectrophoretic mobility at a second location in the non-uniform array.

16. A method according to claim 14, wherein the act of passing the sample fluid across the non-uniform array comprises electrokinetic transport, advection, sedimentation, buoyancy, or magetophoresis.

17. A method according to claim 14, further comprising:

changing the spatially non-uniform electric field such that the dielectrophoretic force on the first particle is decreased; and

transporting the first particle to a second location in the non-uniform array; and

trapping the first particle at the second location.

18. A method according to claim 17, further comprising:

changing the spatially non-uniform electric field such that the dielectrophoretic force on the first particle is decreased; and

transporting the first particle to an outlet port.